

We claim:

1. A dermatologic treatment apparatus that is cordless and sufficiently compact as to be hand-held, comprising:

5 (a) a self-contained housing configured for gripping by a person's hand for cordless manipulation in a dermatologic treatment procedure;

(b) a light source comprising one or more diode laser bars within the housing;

(c) an electrical circuit within the housing comprising one or more batteries and an electronic control circuit for energizing the light source to produce output light pulses;

10 (d) a light path within the housing including an aperture through which the output light pulses are propagated out of the housing having properties that provide efficacious treatment; and

(e) wherein the cordless apparatus has a total weight of no more than one kilogram, and

(f) wherein the cordless apparatus occupies no more than 1500 cm³ of volume.

15 2. The apparatus of claim 1, wherein the dermatologic treatment apparatus is configured for performing a procedure for at least temporary hair-regrowth inhibition.

20 3. The apparatus of claim 2, wherein a light pulse emitted by the apparatus has a pulse duration not less than 10 milliseconds.

4. The apparatus of claim 2, wherein a light pulse emitted by the apparatus has a peak power between 10 watts and 120 watts.

25 5. The apparatus of claim 2, wherein a light pulse emitted by the apparatus has a pulse duration between 10 milliseconds and 1 second.

6. The apparatus of claim 2, wherein a light pulse emitted by the apparatus has an output fluence between 4 J/cm² and 100 J/cm².

7. The apparatus of claim 2, wherein a majority of the energy of a light pulse emitted by the apparatus is contained within a spectral band of 700 nm to 1100 nm.
8. The apparatus of claim 2, wherein a light pulse emitted by the apparatus at the aperture has a
5 spot size between 0.25 cm² and 5 cm².
9. The apparatus of claim 2, wherein the output light pulses are emitted at a pulse repetition frequency between 0.1 Hz and 2 Hz.
- 10 10. The apparatus of claim 1, wherein the dermatologic treatment apparatus is configured for treating acne.
11. The apparatus of claim 10, wherein a majority of the energy of a light pulse emitted by the apparatus is contained in a spectral band of 350 nm to 450 nm or between 1000 nm and 1800 nm,
15 or a combination of both of these ranges.
12. The apparatus of claim 1, wherein the dermatologic treatment apparatus is configured for treating benign pigmented lesions.
- 20 13. The apparatus of claim 1, wherein the dermatologic treatment apparatus is configured for vascular treatment.
14. The apparatus of claim 1, wherein the dermatologic treatment apparatus is configured for skin texture or wrinkle treatment, or both.
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15. The apparatus of claim 1, wherein the electrical circuit comprises a direct drive electrical circuit for energizing the light source.
16. The apparatus of claim 1, wherein the electrical circuit comprises a supercapacitor for
30 energizing the light source.

17. The apparatus of claim 1, further comprising a contact sensor for permitting light pulses to be propagated from the housing only when substantial contact is made between the contact sensor and a contacted surface.

5 18. The apparatus of claim 17, wherein at least one light pulse is triggered when said substantial contact is made.

10 19. The apparatus of claim 1, further comprising a heatsink for contacting a region of an epidermis of a person undergoing treatment, having one or more thermal characteristics that serve to remove heat from the epidermis, and wherein the temperature of the heatsink is at or above a normal skin temperature, wherein a normal skin temperature is a temperature of the skin when not being treated with the device.

15 20. The apparatus of claim 19, wherein the heatsink comprises a sapphire output window.

21. The apparatus of claim 1, further comprising a heatsink for contacting a region of an epidermis of a person undergoing treatment, having one or more thermal characteristics that serve to remove heat from the epidermis, and wherein the temperature of the heatsink is maintained below a normal skin temperature, wherein a normal skin temperature is a temperature of the skin when not being treated with the device.

22. The apparatus of claim 21, wherein the heatsink comprises a sapphire output window.

25 23. The apparatus of claim 1, further comprising an audible feedback component.

24. The apparatus of claim 1, wherein the electronic control circuit comprises a current limiting circuit.

30 25. The apparatus of claim 1, wherein the electronic control circuit comprises a pulsewidth limiting circuit.

26. The apparatus of claim 1, wherein the electronic control circuit comprises a pulse repetition frequency limiting circuit.

27. The apparatus of claim 1, wherein the one or more batteries supply a battery voltage V_{bat} , and the electronic control circuit comprises a one or more field effect transistors (FET's) and a voltage supply, wherein the voltage supply drives the gates of the FET's at a voltage greater than the battery voltage V_{bat} .

28. A dermatologic hair-regrowth-inhibiting apparatus that is cordless and sufficiently compact as to be hand-held, comprising:

- (a) a self-contained housing configured for gripping by a person's hand for cordless manipulation in a hair-regrowth-inhibiting procedure;
- (b) a light source comprising one or more diode laser bars within the housing;
- (c) a direct drive electrical circuit within the housing comprising one or more batteries for energizing the light source to produce output light pulses; and
- (d) a light path within the housing including an aperture through which the output light pulses are propagated out of the housing having properties sufficient for at least temporary hair-regrowth inhibition.

29. The apparatus of claim 28, wherein a light pulse emitted by the apparatus has a pulse duration not less than 10 milliseconds.

30. The apparatus of claim 28, wherein a light pulse emitted by the apparatus has a peak power between 10 watts and 120 watts.

31. The apparatus of claim 28, wherein a light pulse emitted by the apparatus has a pulse duration between 10 milliseconds and 1 second.

32. The apparatus of claim 28, wherein a light pulse emitted by the apparatus has an output fluence between 4 J/cm^2 and 100 J/cm^2 .

33. The apparatus of claim 28, wherein a majority of the energy of a light pulse emitted by the apparatus is contained within the spectral band of 700 nm to 1100 nm.

5 34. The apparatus of claim 28, wherein a light pulse emitted by the apparatus at the aperture has a spot size between 0.25 cm^2 and 5 cm^2 .

35. The apparatus of claim 28, wherein light pulses are emitted at a pulse repetition frequency between 0.1 Hz and 2 Hz.

10 36. The apparatus of claim 28, further comprising a contact sensor for permitting light pulses to be propagated from the housing only when substantial contact is made between the contact sensor and a contacted surface.

15 37. The apparatus of claim 36, wherein at least one light pulse is triggered when said substantial contact is made.

38. The apparatus of claim 28, further comprising a heatsink for contacting a region of an epidermis of a person undergoing treatment, having one or more thermal characteristics that serve to remove heat from the epidermis, and wherein the temperature of the heatsink is at or
20 above a normal skin temperature, wherein a normal skin temperature is a temperature of the skin when not being treated with the device.

39. The apparatus of claim 38, wherein the heatsink comprises a sapphire output window.

25 40. The apparatus of claim 28, further comprising a heatsink for contacting a region of an epidermis of a person undergoing treatment, having one or more thermal characteristics that serve to remove heat from the epidermis, and wherein the temperature of the heatsink is maintained below a normal skin temperature, wherein a normal skin temperature is a temperature of the skin when not being treated with the device.

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41. The apparatus of claim 40, wherein the heatsink comprises a sapphire output window.

42. The apparatus of claim 28, further comprising an audible feedback component.
43. The apparatus of claim 28, wherein the cordless apparatus has a total weight of no more than one kilogram, and occupies a volume of no more than 1500 cm³.
44. The apparatus of claim 28, wherein the electrical circuit comprises a current limiting circuit.
45. The apparatus of claim 28, wherein the electrical circuit comprises a pulsewidth limiting circuit.
46. The apparatus of claim 28, wherein the electrical circuit comprises a pulse repetition frequency limiting circuit.
47. The apparatus of claim 28, wherein the one or more batteries supply a battery voltage V_{bat} , and the electrical circuit comprises one or more field effect transistors (FET's) and a voltage supply, wherein the voltage supply drives gates of the FET's at a voltage greater than the battery voltage V_{bat} .
48. The apparatus of claim 28, wherein the electrical circuit does not comprise one or more storage capacitors for producing electrical pulses to energize the light source by discharging such one or more capacitors.
49. A dermatologic hair-regrowth-inhibiting apparatus that is cordless and sufficiently compact as to be hand-held, comprising:
- (a) a self-contained housing configured for gripping with a person's hand for cordless manipulation in a hair-regrowth-inhibiting procedure;
 - (b) a light source within the housing containing one or more diode lasers;
 - (c) an electrical circuit within the housing comprising one or more batteries and an electronic control circuit for energizing the light source to produce output light pulses;

(d) a light path within the housing including an aperture through which the output light pulses are propagated out of the housing; and wherein

(1) a peak power of a light pulse emitted by the apparatus is between 10 watts and 120 watts;

5 (2) a pulse duration of a light pulse emitted by the apparatus is between 10 milliseconds and 1 second;

(3) an output fluence of a light pulse emitted by the apparatus is between 4 J/cm² and 100 J/cm²;

10 (4) a majority of the energy of a light pulse emitted by the apparatus is contained within a spectral band of 700 nm to 1100 nm.

50. The apparatus of claim 49, wherein the electrical circuit comprises a direct drive electrical circuit for energizing the light source.

15 51. The apparatus of claim 49, wherein the electrical circuit comprises a supercapacitor for energizing the light source.

52. The apparatus of claim 49, wherein a light pulse emitted by the apparatus at the aperture has a spot size between 0.25 cm² and 5 cm².

20 53. The apparatus of claim 49, wherein light pulses are emitted at a pulse repetition frequency between 0.1 Hz and 2 Hz.

54. The apparatus of claim 49, further comprising a contact sensor for permitting light pulses to
25 be propagated from the housing only when substantial contact is made between the contact sensor and a contacted surface.

55. The apparatus of claim 54, wherein at least one light pulse is triggered when said substantial contact is made.

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56. The apparatus of claim 49, further comprising a heatsink for contacting a region of an epidermis of a person undergoing treatment, having one or more thermal characteristics that serve to remove heat from the epidermis, and wherein the temperature of the heatsink is at or above a normal skin temperature, wherein a normal skin temperature is a temperature of the skin when not being treated with the device.
57. The apparatus of claim 56, wherein the heatsink comprises a sapphire output window.
58. The apparatus of claim 49, further comprising a heatsink for contacting a region of an epidermis of a person undergoing treatment, having one or more thermal characteristics that serve to remove heat from the epidermis, and wherein the temperature of the heatsink is maintained below a normal skin temperature, wherein a normal skin temperature is an average temperature of the skin when not being treated with the device.
59. The apparatus of claim 58, wherein the heatsink comprises a sapphire output window.
60. The apparatus of claim 49, further comprising an audible feedback component.
61. The apparatus of claim 49, wherein the cordless apparatus has a total weight of no more than one kilogram, and occupies a volume of no more than 1500 cm^3 .
62. The apparatus of claim 49, wherein the electrical circuit comprises a current limiting circuit.
63. The apparatus of claim 49, wherein the electrical circuit comprises a pulsewidth limiting circuit.
64. The apparatus of claim 49, wherein the electrical circuit comprises a pulse repetition frequency limiting circuit.
65. The apparatus of claim 49, wherein the one or more batteries supply a battery voltage V_{bat} , and the electrical circuit comprises one or more field effect transistors (FET's) and a voltage

supply, wherein the voltage supply drives the gates of the FET's at a voltage greater than the battery voltage V_{bat} .

66. A dermatologic hair-regrowth-inhibiting apparatus that is cordless and sufficiently compact
5 as to be hand-held, comprising:

(a) a self-contained housing configured for gripping by a person's hand for cordless manipulation in a hair-regrowth-inhibiting procedure;

(b) a light source within the housing comprising one or more diode lasers;

(c) a direct drive electrical circuit within the housing comprising one or more batteries for
10 energizing the light source to produce output light pulses;

(d) a light path within the housing including an aperture through which the output light pulses are propagated out of the housing; and wherein

(1) a peak power of a light pulse emitted by the apparatus is between 10 watts and
120 watts;

(2) a pulse duration of a light pulse emitted by the apparatus is between 10
15 milliseconds and 1 second;

(3) an output fluence of a light pulse emitted by the apparatus is between 4 J/cm^2
and 100 J/cm^2 ;

(4) a majority of the energy of a light pulse emitted by the apparatus is contained
20 within a spectral band of 700 nm to 1100 nm;

(5) the cordless apparatus has a total weight of no more than one kilogram;

(6) the cordless apparatus occupies no more than 1500 cm^3 of volume;

(7) light pulses are emitted at a pulse repetition frequency between 0.1 Hz and 2
Hz; and

(8) a light pulse emitted at the aperture has a spot size between 0.25 cm^2 and 5
25 cm^2 .

67. The apparatus of claim 66, further comprising a contact sensor for permitting light pulses to
be propagated from the housing only when substantial contact is made between the contact
30 sensor and a contacted surface.

68. The apparatus of claim 67, wherein at least one light pulse is triggered when said substantial contact is made.

69. The apparatus of claim 66, further comprising a heatsink for contacting a region of an epidermis of a person when the device is in use, having one or more thermal characteristics that serve to remove sufficient heat from the contact epidermis region to reduce or prevent epidermal injury, and wherein the temperature of the heatsink is at or above a normal skin temperature, wherein a normal skin temperature is a temperature of the skin when not being treated with the device.

70. The apparatus of claim 69, wherein the heatsink comprises a sapphire output window.

71. The apparatus of claim 66, further comprising a heatsink for contacting a region of an epidermis of a person undergoing treatment, having one or more thermal characteristics that serve to remove heat from the epidermis, and wherein the temperature of the heatsink is maintained below a normal skin temperature, wherein a normal skin temperature is a temperature of the skin when not being treated with the device.

72. The apparatus of claim 71, wherein the heatsink comprises a sapphire output window.

73. The apparatus of claim 66, further comprising an audible feedback component.

74. The apparatus of claim 66, wherein the light source comprises one or more diode laser bars each comprising multiple laser diode emitters.

75. The apparatus of claim 66, wherein the electrical circuit comprises a current limiting circuit.

76. The apparatus of claim 66, wherein the electrical circuit comprises a pulsewidth limiting circuit.

77. The apparatus of claim 66, wherein the electrical circuit comprises a pulse repetition frequency limiting circuit.

78. The apparatus of claim 66, wherein the one or more batteries supply a battery voltage V_{bat} , and the electrical circuit comprises one or more field effect transistors (FET's) and a voltage supply, wherein the voltage supply drives the gates of the FET's at a voltage greater than the battery voltage V_{bat} .

79. A dermatologic treatment method for cordlessly treating a person's skin, comprising:

(a) gripping in a person's hand a self-contained housing assembly of a dermatologic treatment device;

(b) positioning the housing assembly such that an output window component of the device contacts an epidermis of a same or different person;

(c) energizing a light source comprising one or more diode lasers with an electrical circuit including one or more batteries and an electronic control circuit, each contained within the housing assembly, to produce controlled output light pulses;

(d) transmitting the output light pulses generated by the light source along a light path within the housing including an aperture through which light pulses are propagated from the housing assembly having properties sufficient for efficacious treatment; and

(e) cordlessly manipulating the hand-held, dermatologic device in a skin treatment procedure.

80. The method of claim 79, wherein the energizing comprises energizing one or more laser diode bars each comprising multiple emitters.

81. The method of claim 79, wherein the energizing comprises energizing two or more laser diode bars each comprising multiple emitters.

82. The method of claim 79, wherein the cordless apparatus has a total weight of no more than one kilogram, and occupies no more than 1500 cm^3 of volume.

83. The method of claim 79, wherein the skin treatment procedure comprises an at least temporary hair-regrowth-inhibition treatment.

5 84. The method of claim 79, wherein the energizing comprises direct drive energizing of the light source.

85. The method of claim 79, wherein the energizing comprises generating current pulses for generating light pulses without at least partial discharge of one or more storage capacitors, such that the one or more batteries do not energize such one or more storage capacitors, and instead
10 the energizing comprises one or more batteries directly energizing a light source.

86. The method of claim 79, wherein the energizing comprises generating current pulses for generating light pulses without a transformer.

15 87. The method of claim 79, further comprising producing an output fluence between 4 J/cm^2 and 100 J/cm^2 , and wherein a majority of the energy of a light pulse is contained within the spectral band of 700 nm to 1100 nm, and wherein the light pulses have pulse durations between 10 milliseconds and 1 second.

20 88. The method of claim 87, wherein the light pulses are emitted at a pulse repetition frequency between 0.1 Hz and 2 Hz, have a peak power between 10 watts and 120 watts, and have a spot size at the aperture between 0.25 cm^2 and 5 cm^2 , and wherein the cordless apparatus has a total weight of no more than one kilogram, and occupies no more than 1500 cm^3 of volume.

25 89. The apparatus of claim 49, wherein the light source comprises one or more diode laser bars each comprising multiple laser diode emitters